The following three indicators (2.7 – 2.9) should be selected as appropriate to a particular course for additional content and depth:

C-2.7 Apply the predictable rate of nuclear decay (half-life) to determine the age of materials.

Revised Taxonomy Level   3.2 C$_A$ Apply (use) procedural knowledge
Students did not address this concept in physical science

It is essential for students to
- ❖ Determine the half life of a substance when given the change in the mass of the radioisotope over time. (for example)
  - ➢ Given:
    - ▪ The initial mass of Protoactinium-23 is120 g
    - ▪ The final mass is 1.88 g
    - ▪ The elapsed time is 7 minutes
  - ➢ The sequence for decays would be:
    - ▪ 120g>60g>30g>15g>7.5g>3.75g>1.88g
    - ▪ This is 6 half lives.
  - ➢ So one half life is
    - ▪ 7 minutes / 6 = 1.17 minutes.
- ❖ Interpolate the age of a substance at a given time using a graph of mass vs time
  - ➢ Make a chart by adding 1.17 minutes (the calculated half life) for successive time periods and dividing the mass in half for each successive time period.

Mass (grams)	Time (minutes)
120	0
60	1.17
30	2.34
15	3.51
7.5	4.68
3.75	5.85
1.875	6.92

- ▪ Graph the data
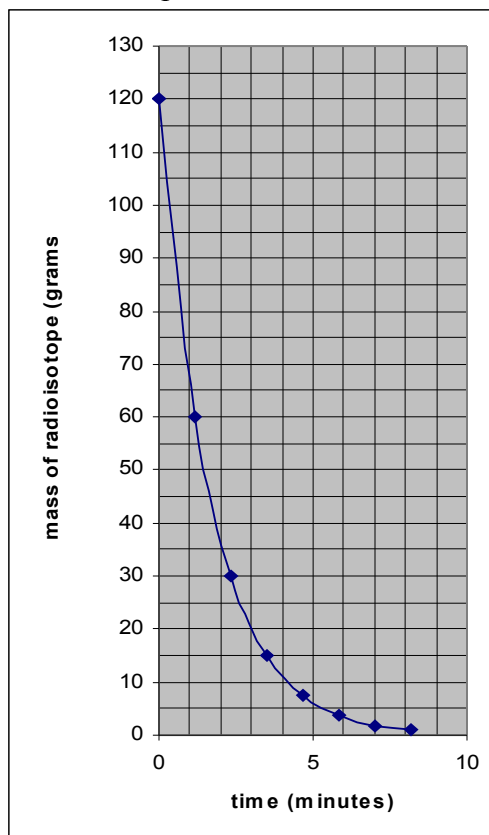
Rate Laws are beyond the scope of most introductory chemistry courses

Assessment
The revised taxonomy verb for this indicator is <u>implement</u> <u>(use)</u>, the major focus of assessment will be for students to show that they can "apply a procedure to an unfamiliar task". The knowledge dimension of the indicator, procedural knowledge means "knowledge of subject-specific techniques and methods" In this case the procedure for determining the half-life of a substance from laboratory data and the use of that data to determine the age of a given specimen. A key part of the assessment will be for students to show that they can apply the knowledge to a new situation, not just repeat problems which are familiar. This requires that students have a conceptual understanding of the decay of radioactive isotopes